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A Simulation Based Approach To Develop Naval Armament Systems

Jere Mackin, Al Sleder, Pradip Kar, and Paul Huang

United Defense

Armament Systems Division

4800 East River Road

Minneapolis, Minnesota 55421

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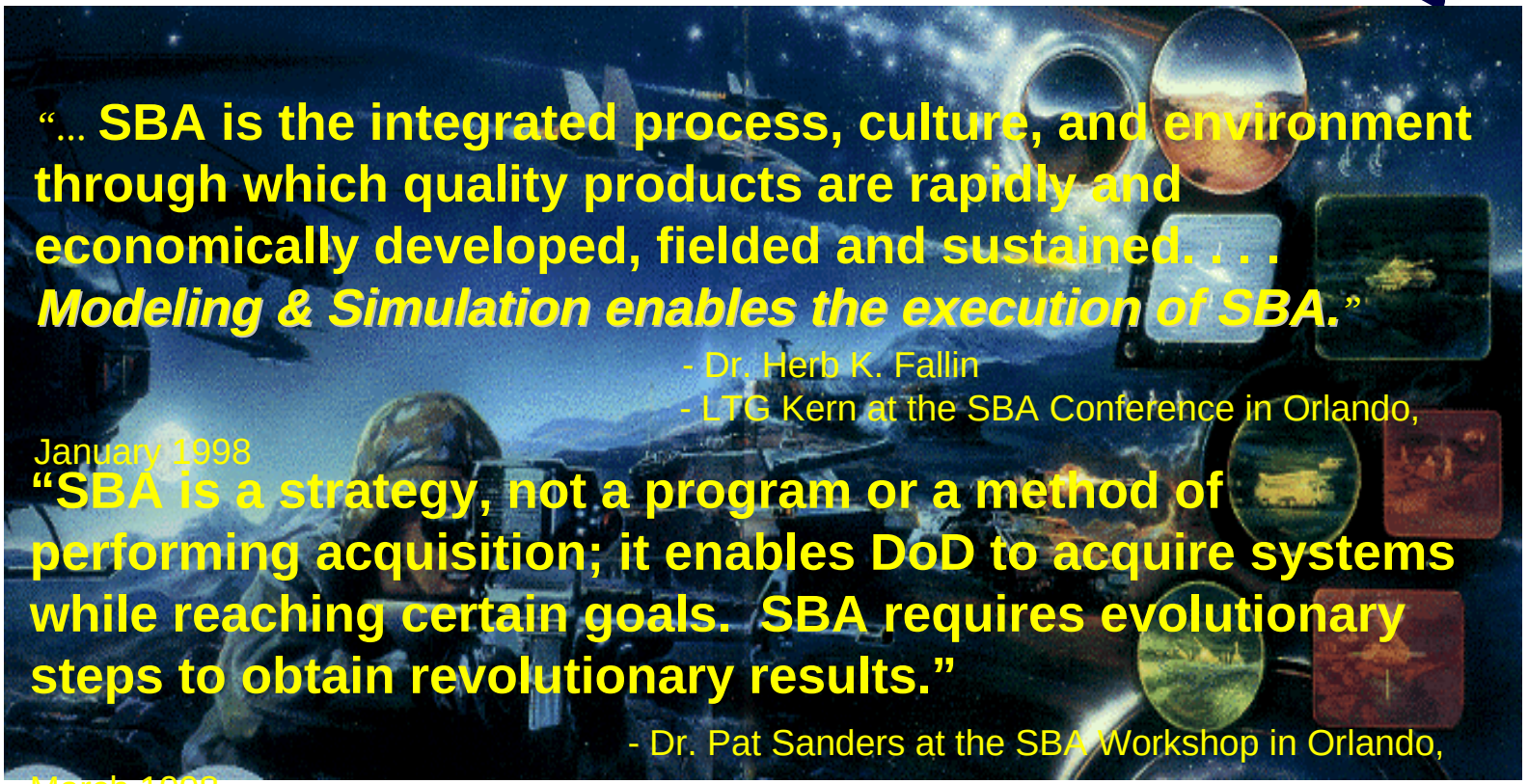
SBA Vision



"... **SBA is the integrated process, culture, and environment through which quality products are rapidly and economically developed, fielded and sustained. . . . *Modeling & Simulation enables the execution of SBA.***"

- Dr. Herb K. Fallin
- LTG Kern at the SBA Conference in Orlando, January 1998

"SBA is a strategy, not a program or a method of performing acquisition; it enables DoD to acquire systems while reaching certain goals. SBA requires evolutionary steps to obtain revolutionary results."

- Dr. Pat Sanders at the SBA Workshop in Orlando, March 1998

". . . to have an Acquisition Process in which DoD and Industry are enabled by robust, collaborative use of simulation technology that is integrated across acquisition phases and programs"

- DoD Vision Statement

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Problem Statement

- **Advanced Gun System is a completely new system with quantum leap in capability to meet 21st Century Naval Fire Support requirements**
- **AGS development encounters many familiar challenges:**
  - **much compressed schedule,**
  - **reduced cost,**
  - **new technology insertion,**
  - **A “new start” with the prime task,**
  - **IOC in 2005**

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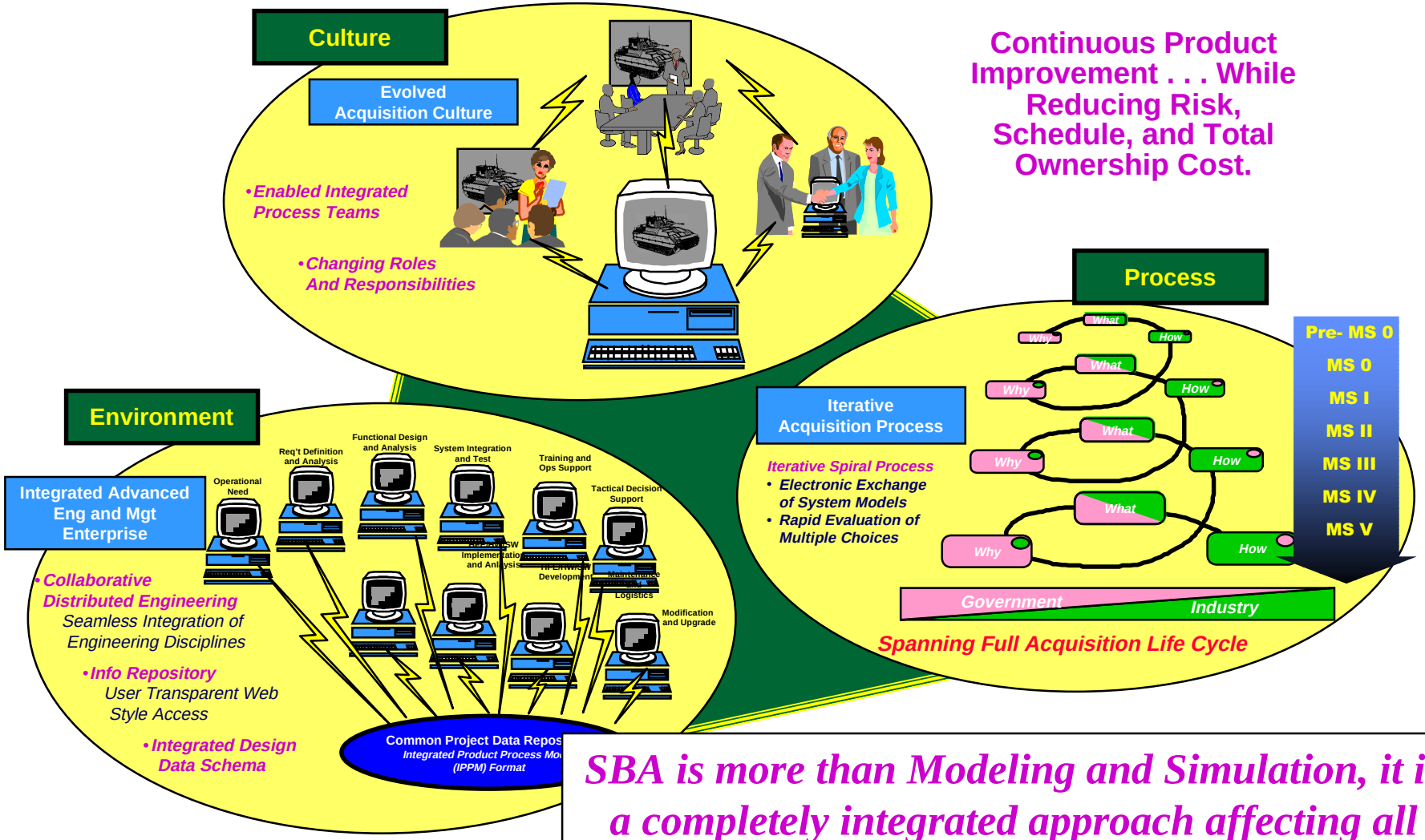
SBA is not just technology



SBA is more than Modeling and Simulation, it is a completely integrated approach affecting all aspects of acquisition . . . A new way of business

Chart based on DoD source

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Building Blocks within United Defense

Culture

- **Integrated Product/Process Teams**

Process

- **Simulation Based Design (SBD)**
- **Simulation-Emulation-Stimulation (SES) Process**
- **Integrated Product CAD/CAM**

Environment

- **Common Operating Environment**
- **Virtual Enterprise Environment**
- **System Integration Environment**
- **Integrated Data/Common Development Environments**

These tools/processes/capabilities are foundation elements of an integrated SBA capability

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Approach

- **Implement an aggressive systems engineering practice**
- **Use all technology elements derived from modeling and simulation from concept development through all life cycle support**
  - **Simulation-Emulation-Stimulation Process**
  - **Rapid prototyping**
  - **Virtual Prototyping**
  - **Simulation-based Test & Evaluation**
  - **CAE tools/Code Generator**
  - **System Integration Environment**

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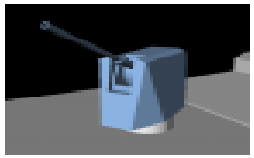
SBA Approach at United Defense

AGS

Mission Area Analysis Mission Need Statement	Concept Exploration	Program Definition/ Risk Reduction	Engineering & Mfg. Development	Production & Fielding	O&S	Disposal

MILESTONE 0 I II III IV V



AGS

Crusader

Grizzly

CHPS

DD21

FSCS

Bradley A3

GRIZZLY
- Focus on Engineering,
- Manufacturing,
- Development & Test
- Complex virtual models

Combat Hybrid Propulsion Sys
- Reconfigurable Crew Station
- Controller Design
- Crew Station Interfaces
- New Engineering Models
  - SIMLink
  - Pulse power
  - Motor control
  - Load control
  - Battery power
  - Wheeled vehicle

CRUSADER
- IPPD- "Partnering" - User, Developer, Industrial Team)
- Integrated Data Environment
- Common Dev Environment
- Simulation Based Development
- SBA Manufacturing Planning
- SBA Product Support Planning (Spiral development/SES based)

BRADLEY A3
- Focus on P3I Integration of Electronics/Software upgrades
- Integrated Test, and Training.
- IPT's
- CITIS, SES
- Tactical code in simulators
- Synthetic Environment Live Fire
- LUT-1, LUT-2, OT&E

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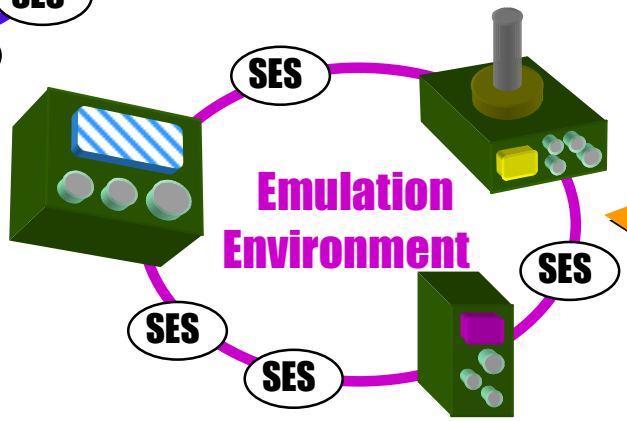
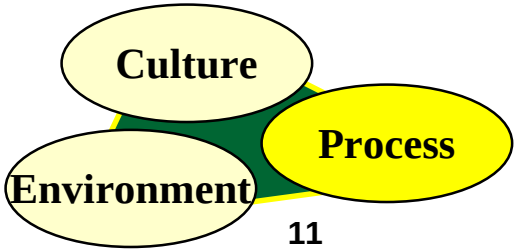
Simulation/Emulation/Stimulation (SES)



SIMULATION	EMULATION	STIMULATION
Functional characteristics of electronics-software subsystems	Electrical interface characteristics between subsystems	Functional/ electrical interfaces to target hardware



MODEL - SIMULATE - TEST - FIX - MODEL

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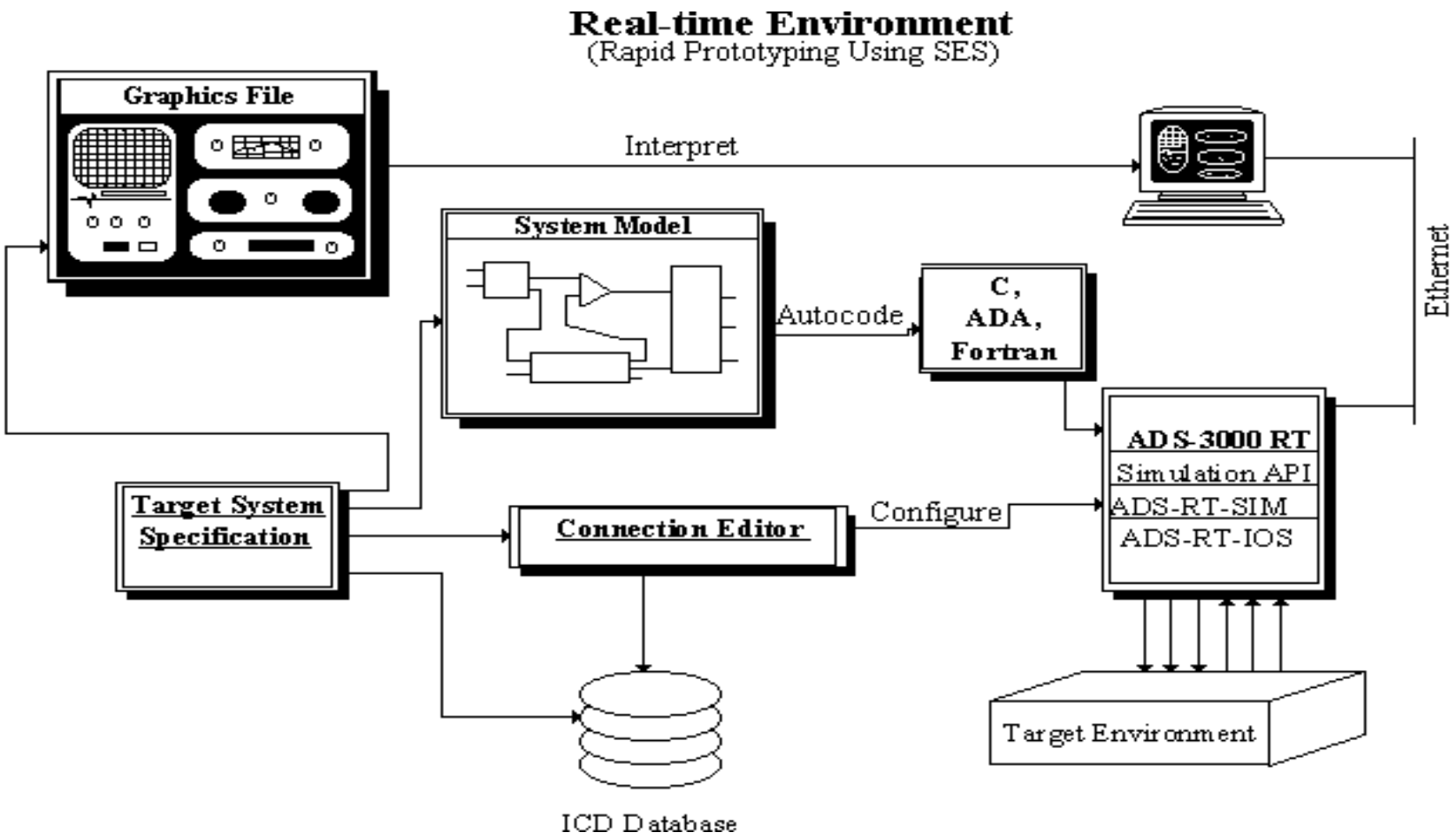
Rapid Prototyping (system)



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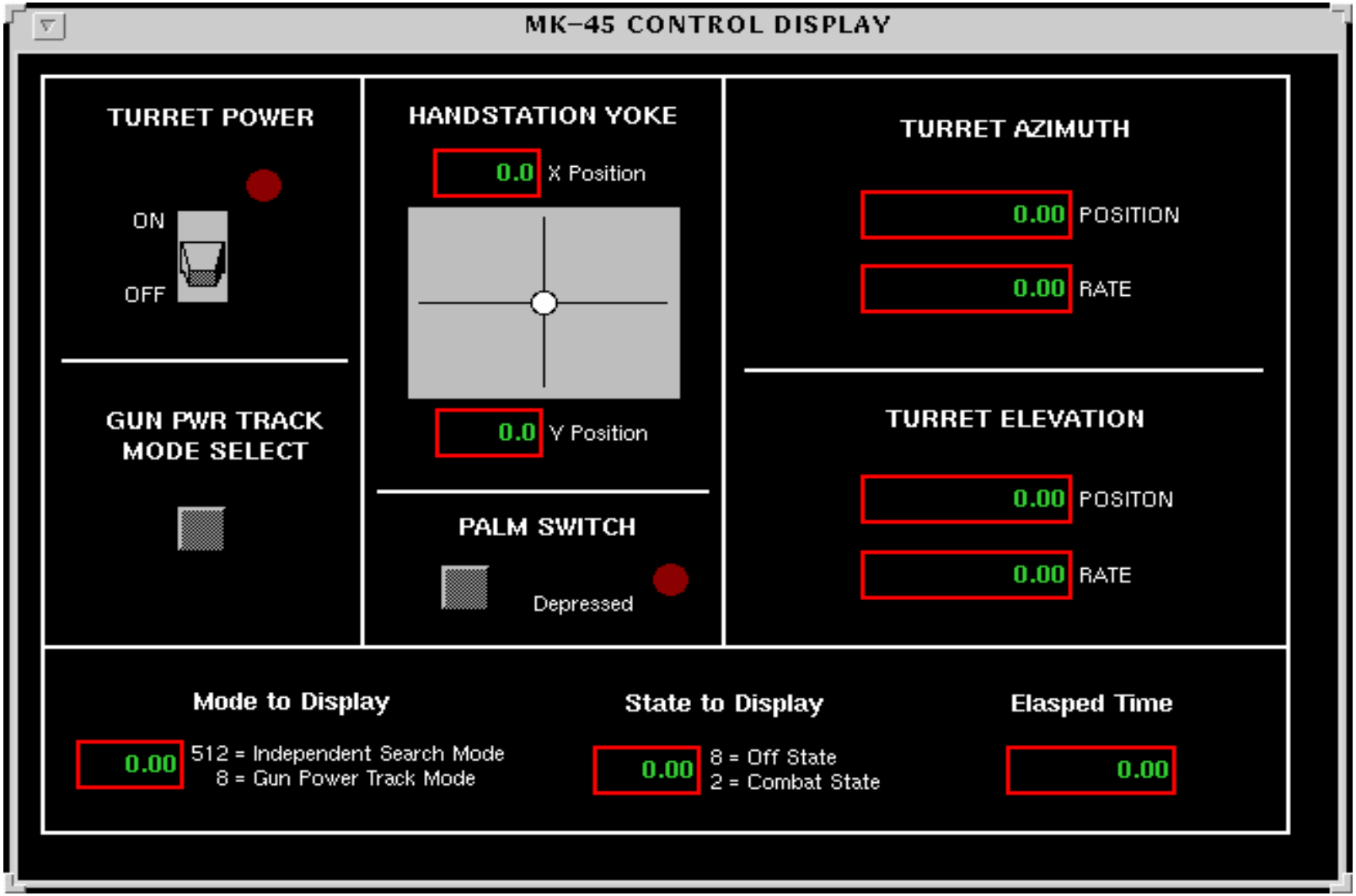
Rapid Prototyping (MMI)



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System Integration Environment

Modeling and Simulation Room

NT Development Environment

AC-1000

NT

NT

NT

NT

NT

NT

SPM/VP Development Environment

NT

AC-1000

SGI

SGI

SGI

SGI

Sun OODBMS

Unix Development Environment

SUN

SUN

SUN

SUN

RS-232 Switchbox

ADS-3000

SUBNET 46

Printer

Portable Demo

NT

NT

NT

SGI

Secure Computing Room

Printer

SGI

SUN

Secure Fax

Secure Phone

File Serving

Apps Serving

ASD Domain

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System Integration Environment

Computer Room

SGI Onyx2

AV Matrix Switcher

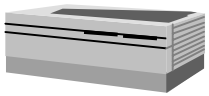
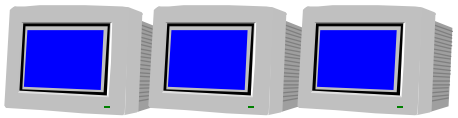


Image Blending

Projection Rack

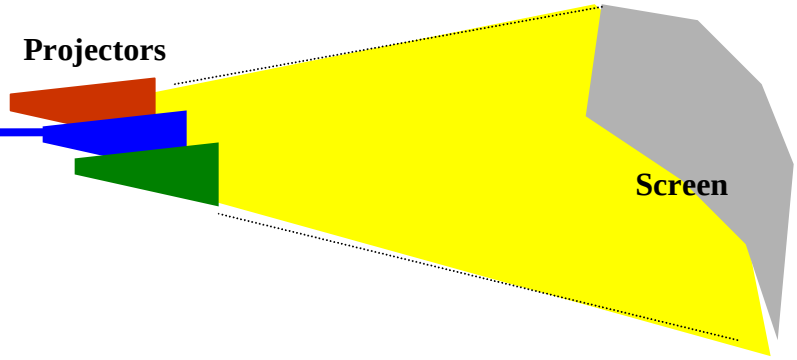
Visual Integration Room

Speakers



3 Monitors

PC



Projectors

Screen

SUBNET 46

File Serving

Apps Serving

ASD Domain

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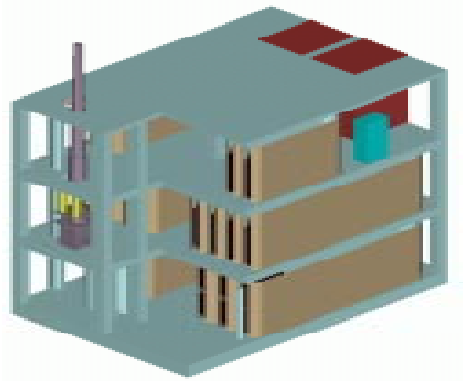
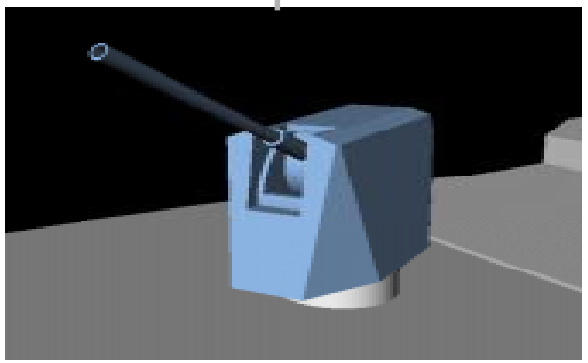
Naval Gun Virtual Prototype

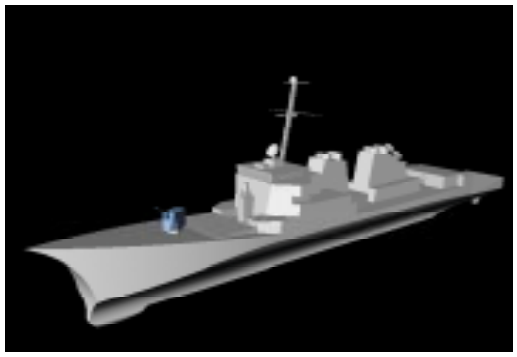
Tcl/Tk Control Panel
DIADEM Real-Time
State Machine
(Sun Ultra Sparc)



EAI Magazine Model
with ERGM and Propellant
(SGI)



EAI Gun and Loader
(SGI)



Coryphaeus Flyout
(SGI)

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Virtual Prototyping (process)

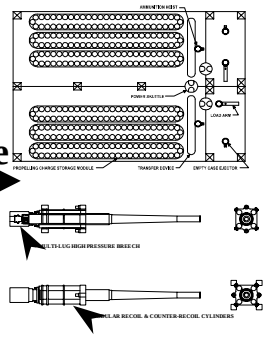
System Integration Env. Feature

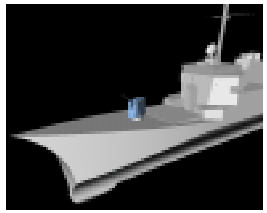
- Rapid virtual prototyping
- Realistic visual views of operation
- 3D real-time animation
- Ready for HWIL operation
- Test & Evaluation capability
- Automated ICD downloading
- DIS capability

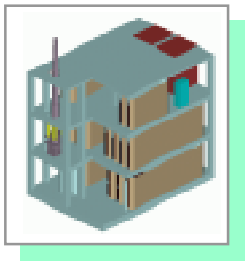
SGI

ProE Drawing of Gun, Magazine & module structure

(ProE)







Sun

MatrixX Family CASE Tool

(SystemBuild)

Control Algorithm Development

(AutoCode)

Ada or C Code

VME Real-time Controller

SGI

Sun

GUI Builder

(Tcl/Tk, etc.)

Simulated 3D controls, panels &displays

T & E

Auto ICD Downloading

- Multiprocessor based Real-Time Controller
- Multi-Channel I/F HW/SW
- HW/SW-in-the-loop

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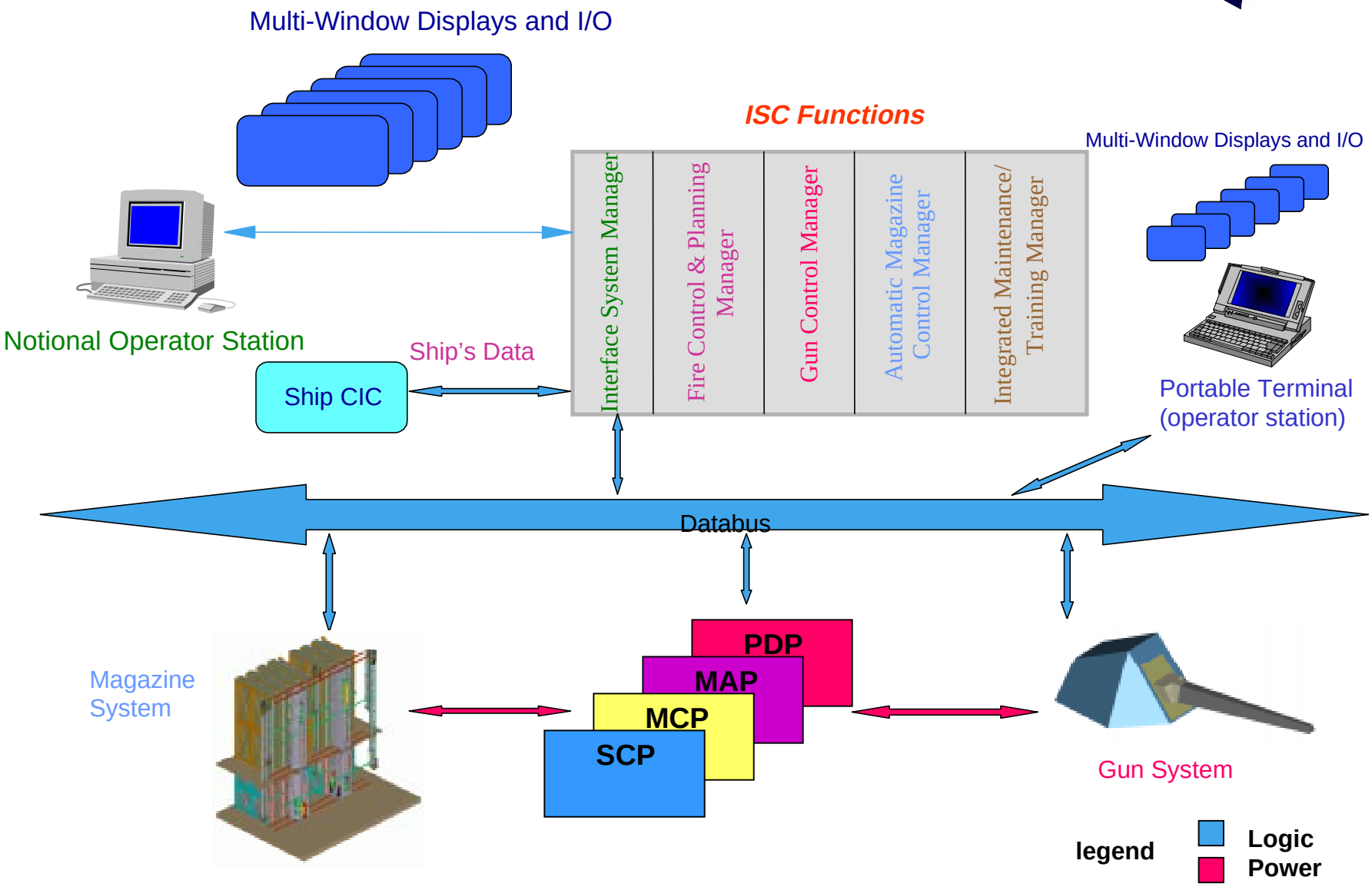
AGS Concept (preliminary)



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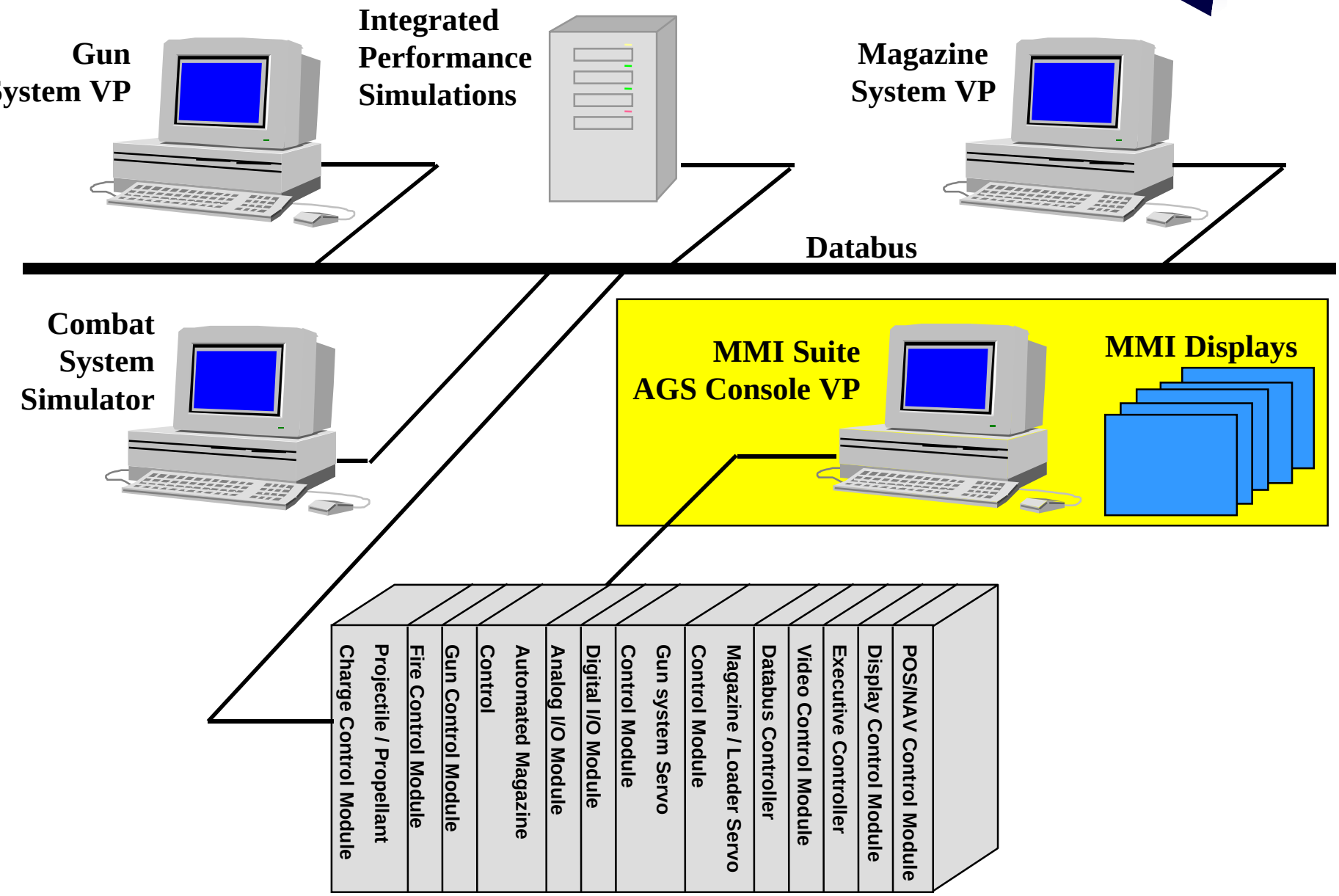
AGS M&S Concept (preliminary)



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Conclusion

- Support concurrent engineering practice for parallel system development
- Enable IPPD from requirements definition and initial concept development through testing, manufacturing, and fielding
- Automated software development
- Supply a near realistic operational environment for customers and future users during development for system modification and improvement
- Provide a low (relatively) cost risk mitigation methodology
- Start system integration before completing the design
- Provide system full life cycle support